FOREST INSECT SURVEY

LASSEN NATIONAL FOREST AND ADJACENT PRIVATE LANDS

Season of 1949

By

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INTRODUCTION

Each year since 1931, the Berkeley Forest Insect Laboratory, Bureau of Entomology and Plant Quarantine, has conducted a bark-beetle survey of the timber lands comprising the Lassen National Forest and adjacent private lands for the purpose of obtaining reliable information concerning the nature and character of insect-caused tree mortality and to advise the timber-managing agencies as to the needs for control. The scope and intensity of the annual insect survey has varied directly with the funds and manpower available for such work, the nature of known, or potential, destructiveness on the part of several tree-killing insects, and the possibility of controlling any infestation that might be found. For the most part, forest insect survey activities in the past years have been concentrated in the Eastern Lassen, Susanville, and Burney Areas inasmuch as this vast body of commercial timber was suffering heavy depletion by bark beetles and was of greatest concern to federal, state and

private owners. Surveys to detect insect outbreaks have also been maintained throughout the westside Lassen Area, but seldom was insect-caused tree mortality in this portion of the National Forest ever sampled by plot measurements as topographic viewing and general reconnaissance usually were sufficient to detect incipient forest insect outbreaks and to formulate plans for control. Subsequent to each annual insect survey detailed reports were prepared giving the measured amount of insect-caused tree mortality on established sample plots, and estimate of total drain throughout the measured areas and pointing out conditions where control was needed. In all cases, surveys were concentrated in virgin stands and only a small amount of sampling was ever conducted in the cutover reserve.

During 1949, increased appropriations were made available to the Bureau of Entomology and Plant Quarantine under provisions of the Forest Pest Control Act (Public Law #110, 80th Congress) for the purpose of expanding forest insect surveys to insure that insect outbreaks would be detected in their early stages, and control initiated before epidemic conditions and heavy loss could occur. Under the impetus of this expanded survey program in 1949 additional plots were added for the sampling of loss in the eastside Lassen Area and similar plots were established in the westside Lassen Area as well. In addition, the entire forest and all adjacent lands were viewed from the air during October to make sure no serious infestations or small centers of heavy loss had escaped detection during plot examinations.

The Lassen National Forest and adjacent private timberlands vary considerably in stand compositions, tree species, site, and are particularly different as to problems related to successful control of insect pests. The Eastern Lassen Area, the Susanville Area, and the Burney Area

are predominantly "eastside" types of pure ponderosa and Jeffrey pine, with some incense cedar and white fir at higher elevations. The westside Lassen Area is a mixed conifer type forest with sugar pine and ponderosa the commercially predominant species.

Most of the previous reports of annual forest insect conditions on the Lassen National Forest, together with recommendations for control, have been made for specific reporting areas, particularly the eastside pine types. It is felt that continuity of reporting can best be served by segregating tables of loss records and control recommendations into three areas; namely, (1) The Eastern Lassen and Susanville Areas, (2) The Burney Area, and (3) The Westside Lassen Area. Until more uniform reporting areas can be established in the westside Lassen Area present loss conditions are presented in this report by regional delineations of timber-management working circles. (See the appended map).

EASTERN LASSEN AND SUSANVILLE AREAS

FIELD EXAMINATION:

Personnel: Gilbert A. Ward, Thomas G. McElroy, Boyd Wickman and E. T. Engen, Forest Insect Laboratory, Bureau of Entomology and Plant Quarantine, 29 Forestry Building, U. C., Berkeley 4, California.

Date: June 20 to September 7, October 3 to October 7, 1949.

Methods: Insect-caused tree mortality was measured on roadside sample strips, half-section plots and trail strips. Intensive ground and air reconnaissance supplemented plot measurements.

AREAS EXAMINED:

The measurement of all current insect-caused tree mortality was made on 6,736 acres of plots and strips sampling 269,000 acres of virgin pine

timber lands in the Eastern Lassen and Susanville Areas. Trees which were killed by insects during 1947 were also recorded on all new sample plots or strips in order to supplement previous loss records and determine current infestation trends.

CONDITIONS ENCOUNTERED DURING THE COURSE OF THE SURVEY

The heaviest timber losses encountered during the course of the survey occurred in virgin stands, as was to be expected, but some tree mortality was also prevalent in much of the cutover reserve. Bark beetles and other cambium-mining insects were responsible for the majority of all trees killed, but low winter temperatures during 1948-1949 caused some killing of young trees along the edges of open flats. In many instances, lightning had struck trees prior to the time that insects had made their attacks, although only a small percentage of the total loss occurred in this category. Windthrown trees were noted only in a few instances. On most parts of the reporting areas, killing of Jeffrey pine, a result of attacks by the Jeffrey pine beetle, showed an increase over the low level of loss that has been sustained in this tree species for the past several years. In no case, however, were epidemic loss conditions encountered. Measured mortality in ponderosa pine was not severe, although late fall observations indicated that a general upward trend in loss rate is to be expected.

AGENTS RESPONSIBLE FOR TREE MORTALITY DURING 1948 AND 1949

Several species of bark beetles and other cambium-mining insects were found attacking and killing the major tree species in all of the areas examined. In addition, an unusual condition of partial top-killing in pine was noted in several areas in or near open flats. In this latter instance, large overmature and isolated trees had only the top portions

of the crown killed. Examination of some of these trees indicated that insects were not responsible for the killing, although the dead tops contained scattered attacks by Ips oregoni. A similar top-dying condition of ponderosa pine surrounding open flats occurred in the Lassen National Forest in 1947 and Wagener 2/ reported that sudden cold following a mild period might be suspected as responsible for the die-back.

Following is a list of the insect pests responsible for tree mortality as encountered during the course of the surveys:

(1) The western pine beetle, Dendroctonus brevicomis Lec., is the primary insect responsible for the killing of ponderosa pine. A majority of the total timber loss was caused by this forest pest.

(2) The Jeffrey pine beetle, D. jeffreyi Hopk., is the primary species which was found attacking and killing Jeffrey pine. Current loss in this tree species is somewhat greater than has occurred during the past several years.

(3) The mountain pine beetle, D. monticolae Hopk., was often found in association with the western pine beetle in attack on ponderosa pine, but it did not occur in large numbers anywhere. Only an occasional sugar pine was found to be infested by this insect.

(4) The Oregon pine engraver beetle, Ips oregoni Eich., was found attacking and killing both ponderosa and Jeffrey pines. Attacks were usually limited to the upper portions of larger trees although several areas were found where the entire tree of smaller size had been killed.

(5) The California flatheaded borer, Melanophila californica Van Dyke, was found in many of the ponderosa and Jeffrey pines which had been attacked and killed by bark beetles.

2/ Wagener, W. W. 1949. Top Dying of Conifers from Sudden Cold. Jour. Forestry 47:49-53

(6) The fir engraver beetle, Scolytus ventralis Lec., and the round-headed fir borer, Tetropium abietis Fall, were found killing white fir. In some cases, considerable top-killing of young firs was caused by the engraver beetle.

CHARACTER OF INFESTATIONS DURING 1948 AND 1949

For the most part, infestations during 1948 and 1949 were endemic in character and infested trees occurred as singly-killed individuals and usually were well scattered throughout the forest. Group loss, an early sign of approaching epidemic conditions, was not encountered and only occasionally were pairs of infested trees found. Of particular note was the general low level of loss in the "fringe areas" along the northern and eastern portion of the Eastern Lassen Area, and a higher rate of loss in areas of better site quality along the western portion of the reporting area. The rate of Jeffrey pine mortality showed a two-fold increase over conditions encountered during 1947, but total loss still does not approach epidemic levels.

TREND OF BARK BEETLE INFESTATIONS

The rate of tree-mortality resulting from attack by bark beetles throughout the Eastern Lassen and Susanville Areas during the past several years, Figure 1, shows a gradual upward trend in loss from the low point in the infestation during 1944. The slight increase in loss during 1948 is not alarming, but indicates that the entire area must be watched closely to detect signs of possible heavy infestation. This close surveillance is needed, particularly in the pure stand of ponderosa pine throughout the Bogard Buttes, Stephens Ranch, and Butte Creek reporting units, as these particular areas have shown a rather high rate of loss for the past few years. The loss rate for these three areas during 1948 amounted

to 108 board feet per acre, nearly twice the average rate of loss for the Eastern Lassen Area as a whole.

INSECT-CAUSED LOSS ON SAMPLE PLOTS DURING 1948

Each year an inventory is made of tree mortality resulting from insect attacks on the series of sample plots scattered throughout the forested region in order to determine the amount, kind and intensity of insect activity, and to appraise the severity of infestations. A summary of the plot measurements; the number of the trees killed, the board foot volume of loss and percent of stand depleted is given in table 1. The severity of loss, as indicated by table 1, was quite variable on the respective samples, but in each case, the major portion of the total loss occurred in ponderosa pine. As compared to previous years, an increasing rate of loss was measured for Jeffrey pine.

ESTIMATED INSECT-CAUSED LOSS IN VIRGIN STANDS DURING 1948

By expanding the amount of insect-caused tree mortality as measured on the sample plots to the total virgin timbered acreage as of January 1, 1948, it is possible to estimate the total loss occurring throughout the reporting area. By expanding the average per acre plot loss measurements it is estimated that bark beetles and other cambium-mining insects killed a total of more than 18 million board feet of pine timber during the year, a loss of approximately 0.5 percent of the current merchantable stand volume. A distribution of the estimated tree mortality during 1948 on the several entomological units making up the reporting areas is given in table 2.

BARK BEETLE LOSS DURING 1949

Because bark beetles often continue their activity in green trees for several months after the annual survey is made, it is not possible

to determine the total loss for any given year until a remeasurement of mortality is made the following spring. For that reason, no attempt is made here to compare the total 1949 loss with that of 1948. However, from a partial record of loss, as determined during the course of the 1949 survey, it is possible generally to determine the relationship of current conditions to those of 1948. Partial loss measurements, completed during July, indicate a decline in infestations. However, results of the aerial reconnaissance made in late October indicate a general rise in all infestations, particularly in ponderosa pine, and it can be expected that the total loss for 1949 will show a material increase over losses sustained in 1948 when records are complete.

CONDITIONS IN CUTOVER RESERVE STANDS

Prior to 1937, the general practice in cutting ponderosa pine in the Eastern Lassen and Susanville Areas was to remove approximately 70 percent of the merchantable green stand. Since 1937, there has been a gradual shift in cutting practices to reserve a higher percentage of the green volume, and in many cases, limit cutting to trees of high risk to insect attack. Because of the change in cutting practice, several plots sampling insect-caused mortality on the areas where 70 percent or more of the stand has been cut, were abandoned and, at present, plot measurements of loss in the cutover reserve is being maintained only on areas treated by sanitation-salvage methods. In a few cases, "selectively cut" areas are being sampled on the Blacks Mountain Experimental Forest. During 1948, plots sampling losses on cutover areas totaled 1,496 acres.

In general, current conditions of loss throughout the cutover reserve are not severe, and only an occasional dead tree is to be found. The benefits of light cutting as a measure to reduce insect-caused loss is

indicated by the following comparison of loss on cut areas versus the average mortality in virgin land throughout the Eastern Lassen Area for 1948.

	INSECT-CAUSED LOSS...BOARD FEET PER ACRE		
	Ponderosa Pine	Jeffrey Pine	Total Loss
Virgin Timberlands	49.3	15.8	65.1
Sanitation-salvage Cut Areas	4.5	0.3	4.8

In one or two instances, losses on areas cutover by sanitation-salvage methods were somewhat above the average of cut areas as a whole, but it is felt that post logging disturbances were responsible for the higher rate of loss and that this condition will soon be abated.

CONTROL RECOMMENDATIONS

Current bark-beetle infestations throughout the Eastern Lassen and Susanville Areas are not of sufficient magnitude to warrant any action for direct control. However, the current estimated drain on forest resources of over 18 million board feet cannot be overlooked and every possible effort should be taken to further reduce this loss by light sanitation-salvage type cuttings. This method of treating eastside pine areas has proved very successful, not only in reducing current mortality, but also in tempering the conditions leading to possible outbreaks and heavy loss. It is urged that sanitation-salvage cuttings be extended into areas which have thus far not received the benefit of this type of treatment. In particular, Bogard Buttes, Butte Creek and portions of Stephens Ranch reporting units should be given high priority in any future sales plan. The Ladder Butte country also shows a rather high loss rate and every effort should be made to treat this area.

Table 1. Pine Timber Killed by Bark Beetles on Virgin Sample Plots During 1948, Eastern Lassen and Susanville Areas, Lassen County, California

Ento. Unit	Sample Plot No.	Timb'd Acres	Hazard Rating	Pine Stand Tree Spp.	Pine Stand Volume M.B.M.	Timber Killed in 1948 No. of trees	Timber Killed in 1948 Volume (B.M.)	Timber Killed in 1948 Volume p/a	Timber Killed in 1948 Percent of stand
				EASTERN LASSEN AREA					
Coble Mt.	RD-1	160	V	PP	670	2	720	4.5	0.11
				JP	110	None	None	None	None
				Total	780	2	720	4.5	0.09
	RD-2	160	V	PP	670	12	5180	32.4	0.77
				JP	110	None	--	--	--
				Total	780	12	5180	32.4	0.66
Dixie Valley	RD-25	80	V	PP	370	2	400	5.0	0.11
				JP	270	1	2950	36.9	1.09
				Total	640	3	3350	41.9	0.52
Nigger Springs	RD-4	160	IV	PP	40	5	12880	80.5	32.20
				JP	1170	2	5140	32.1	0.44
				Total	1210	7	18020	112.6	1.49
	RD-5	160	IV	PP	1680	6	6560	41.0	0.39
				JP	610	None	--	--	--
				Total	2290	6	6560	41.0	0.29
	RD-51	160	IV	PP	860	2	2150	13.4	0.25
				JP	890	4	5460	34.1	0.61
				Total	1750	6	7610	47.5	0.43
	RD-52	160	IV	PP	860	None	--	--	--
				JP	890	2	2060	12.9	0.23
				Total	1750	2	2060	12.9	0.12
	RD-54	160	IV	PP	860	8	8830	55.2	1.02
				JP	890	1	--	--	--
				Total	1750	9	8830	55.2	0.50
	L-6	320	IV	PP	2620	19	8020	25.1	0.31
				JP	260	None	--	--	--
				Total	2880	19	8020	25.1	0.28
Beaver Creek	RD-3	160	IV	PP	780	2	420	4.5	0.05
				JP	620	1	--	--	--
				Total	1400	3	420	4.5	0.03
	RD-6	160	III-IV	PP	440	None	--	--	--
				JP	820	1	6060	37.9	0.76
				Total	1260	1	6060	37.9	0.48
	RD-50	160	IV	PP	610	2	2100	13.1	0.34
				JP	720	6	10270	64.2	1.43
				Total	1330	8	12370	77.3	0.93
	L-13	260	IV	PP	1050	13	10490	40.3	0.99
				JP	260	1	2680	10.3	1.31
				Total	1310	14	13170	50.6	1.05
Gordon Valley	RD-24	80	III-IV	PP	1600	4	8120	101.5	0.51
				JP	910	None	--	--	--
				Total	2510	4	8120	101.5	0.32
	RD-39	72	IV	PP	1600	3	2920	40.6	0.18
				JP	910	1	140	1.9	0.02
				Total	2510	4	3060	42.5	0.12
Butte Creek	RD-8	160	III	PP	530	2	4000	25.0	0.75
				JP	1270	3	4990	31.2	0.39
				Total	1800	5	8990	56.2	0.50
	RD-9	160	III	PP	360	4	7280	45.5	2.02
				JP	1410	5	8860	55.4	0.63
				Total	1770	9	16140	100.9	0.91
	RD-10	160	III	PP	1690	4	15470	96.7	0.92
				JP	1280	2	1840	11.5	0.14
				Total	2970	6	17310	108.2	0.58
	RD-42	160	IV	PP	610	1	590	3.7	0.97
				JP	1290	None	--	--	--
				Total	1900	1	590	3.69	0.31
	L-12	320	III	PP	1080	7	9300	29.1	0.86
				JP	2220	3	7580	23.7	0.34
				Total	3300	10	16880	52.8	0.54
Halls Flat	RD-7	160	IV	PP	90	1	4000	25.0	4.44
				JP	1160	4	8420	52.5	0.73
				Total	1250	5	12420	77.5	0.99
	RD-29	160	III-IV	PP	620	4	4180	26.1	0.67
				JP	760	None	--	--	--
				Total	1380	4	4180	26.1	0.30
Harvey Valley	RD-31	160	IV	PP	2280	8	12300	76.9	0.54
				JP	220	4	3530	22.1	1.60
				Total	2500	12	15830	99.0	0.63
	L-3	320	III	PP	4130	17	34480	101.8	0.35
				JP	650	11	15940	49.8	2.45
				Total	4780	28	50420	151.6	1.05
Bogard Buttes	RD-11	160	III	PP	470	7	12160	76.0	2.59
				JP	2060	8	11950	74.7	0.56
				Total	2530	15	24110	150.7	0.95
Stephens Ranch	RD-14	160	III	PP	2650	3	6100	38.1	0.23
	RD-41	160	III	PP	2330	4	2470	15.4	1.06
Merrill Flat	RD-33	89	III-IV	PP	2340	4	7000	78.7	0.30
				JP	160	None	--	--	--
				Total	2500	4	7000	78.7	0.28
	RD-34	160	III-IV	PP	1600	None	--	--	--
				JP	400	None	--	--	--
				Total	2000	None	--	--	--
Blacks Mtn.	L-16	287	III	PP	1620	18	15050	47.0	0.93
				JP	1410	None	--	--	--
				Total	3030	18	15050	47.0	0.50
	BMEF	1236	IV	PP	19500	105	123330	99.8	0.63
				JP	1510	5	7340	5.9	0.49
				Total	21010	110	130670	105.7	0.62
Total		6576		PP	59940	269	326500	49.6	0.54
				JP	26190	65	105210	16.0	0.40
				Total	86130	334	431710	65.6	0.50
				SUSANVILLE AREA					
Willard Creek	RD-35	160	III-IV	PP	860	2	5600	35.0	0.65
				JP	1570	1	980	16.3	0.06
				Total	2430	3	6580	51.3	0.27
Total		160		PP	860	2	5600	35.0	0.65
				JP	1570	1	980	16.3	0.06
				Total	2430	3	6580	51.3	0.27
Total of E. Lassen and Susanville Areas		6736		PP	60620	271	332100	49.3	0.55
				JP	27760	66	106190	15.8	0.38
				TOTAL	88380	337	438290	65.1	0.50

Table 2. Estimated Virgin Pine Timber Killed by Bark Beetles in 1948. Eastern Lassen and Susanville Areas, Lassen County, California.

Entomological Units	Virgin Pine Stand (As of Jan. 1, 1949) Acreage	Tree Spp	Vol. MBM	Pine Timber Killed in 1948 No. Trees	Volume M.B.M.	bm/acre	% stand
EASTERN LASSEN AREA							
Coble Mtn.	18,030	PP	93,050	1028	426	23.6	0.48
		JP	9,690	198	85	4.7	0.89
Dixie Valley	5,850	PP	29,070	146	29	5.0	0.10
		JP	14,000	70	216	36.9	1.54
Nigger Spring	14,830	PP	73,110	237	798	53.8	1.09
		JP	86,320	208	294	19.8	0.34
Beaver Creek	16,740	PP	113,380	301	243	14.5	0.24
		JP	45,060	234	470	28.1	1.04
Straylor Lake	6,220	PP	43,680	112	341	54.8	0.78
		JP	22,670	37	114	18.4	0.50
Gordon Valley	9,820	PP	85,320	285	386	39.3	0.45
		JP	37,400	59	98	10.0	0.26
Butte Creek	26,540	PP	220,670	504	1061	40.0	0.48
		JP	117,640	372	648	24.4	0.55
Halls Flat	11,150	PP	17,040	513	854	76.6	5.01
		JP	75,070	424	585	52.5	0.78
Blacks Mtn.	20,320	PP	232,720	1585	1670	82.2	0.72
		JP	87,940	122	73	3.6	0.08
Harvey Valley	10,870	PP	137,660	370	648	59.6	0.47
		JP	18,650	217	261	24.0	1.40
Cave Mountain	9,760	PP	86,570	283	388	39.8	0.48
		JP	24,010	49	6	0.6	0.02
Bogard Buttes	16,840	PP	190,240	707	1292	76.7	0.68
		JP	80,160	556	798	47.4	0.99
Stephens Ranch	26,600	PP	388,220	1543	2296	86.3	0.59
		JP	11,920	879	1325	49.8	1.11
Crater Mountain	5,380	PP	73,720	156	195	36.3	0.26
		JP	12,880	32	23	4.3	0.18
Merrill Flat	5,870	PP	64,210	164	231	39.3	0.34
		JP	15,260	35	64	10.9	0.42
		SP	11,480	102	211	30.6	1.83
Brockman Flat	7,580	PP	4,340	227	398	52.5	0.92
		JP	20,660	45	80	10.5	0.39
Eastern Lassen Area Sub-total	212,400	PP	1,853,000	8161	11256	53.0	0.60
		JP	679,330	3537	5140	24.2	0.76
		SP	11,480	102	211	1.0	1.83
		TOTAL	2,543,810	11800	16607	78.2	0.65
SUSANVILLE AREA							
Merrillville	4,210	PP	36,460	101	160	38.0	0.44
		JP	5,170	21	42	10.0	0.81
Piute Creek	8,310	PP	82,080	199	316	38.0	0.38
		JP	9,020	42	83	10.0	0.92
Susan River	6,210	PP	61,560	80	112	18.0	0.18
		JP	22,060	63	93	15.0	0.42
Robbers Creek	8,720	PP	3,060	58	70	8.0	2.29
		JP	135,050	51	57	6.5	0.04
Coppervale	1,980	PP	19,120	56	63	31.8	0.33
		JP	15,070	65	77	38.9	0.51
Willard Creek	4,210	PP	25,410	26	43	10.2	0.17
		JP	22,480	21	34	8.1	0.15
Mountain Meadows	4,120	PP	30,370	36	48	11.6	0.16
		JP	33,860	51	64	15.5	0.19
Diamond Mountain	18,880	PP	179,710	347	323	17.1	0.18
		JP	60,120	101	126	6.6	0.21
		SP	6,110	46	106	5.6	0.17
Susanville Area Sub-total	56,640	PP	437,770	903	1135	20.0	0.26
		JP	302,830	415	576	10.2	0.19
		SP	6,110	46	106	5.6	0.17
		TOTAL	746,710	1364	1817	35.8	0.24
Total for Eastern Lassen and Susanville Areas	269,040	PP	2,290,770	9064	12391	46.1	0.54
		JP	982,160	3952	5716	21.2	0.58
		SP	17,590	148	317	1.2	0.18
		TOTAL	3,290,520	13164	18424	68.5	0.56

BURNEY AREA

A field cruise measuring current insect-caused loss was made on 5,860 acres of plots and roadside strips sampling 160,000 acres of virgin timberlands in the respective entomological units of the Burney Area as shown in the appended map.

CONDITIONS ENCOUNTERED DURING THE COURSE OF THE SURVEY

Stand depletion due to bark beetles and other cambium-mining insects was of a low endemic nature throughout the virgin timberlands. Some loss was observed in the cutover reserve, but incidence of attack was considerably below that sustained in virgin areas. A small portion of the measured loss could not be attributed directly to tree-killing insects, but was the result of lightning strikes and windthrow. Over fifty percent of the total insect-cause loss was in ponderosa pine with the remaining mortality nearly equally divided between sugar pine and white fir.

CHARACTER OF INFESTATIONS DURING 1948 AND 1949

Timber drain caused by insects during 1948 was the lowest since an annual measurement of tree mortality was begun in this area. Loss was scattered throughout the timber as individual trees; there was no group killing observed, and only occasionally were pairs of infested trees found. The highest concentration of total pine loss was found on the two entomological units containing the greatest concentration of high risk timber in the Burney Area, namely, the Burney Flat and Hat Creek units. The loss rate on these units was approximately three times as great as that on the other units in the reporting area.

The greatest proportion of loss was composed of ponderosa and sugar pine species, with a marked increase in sugar pine loss over that of the

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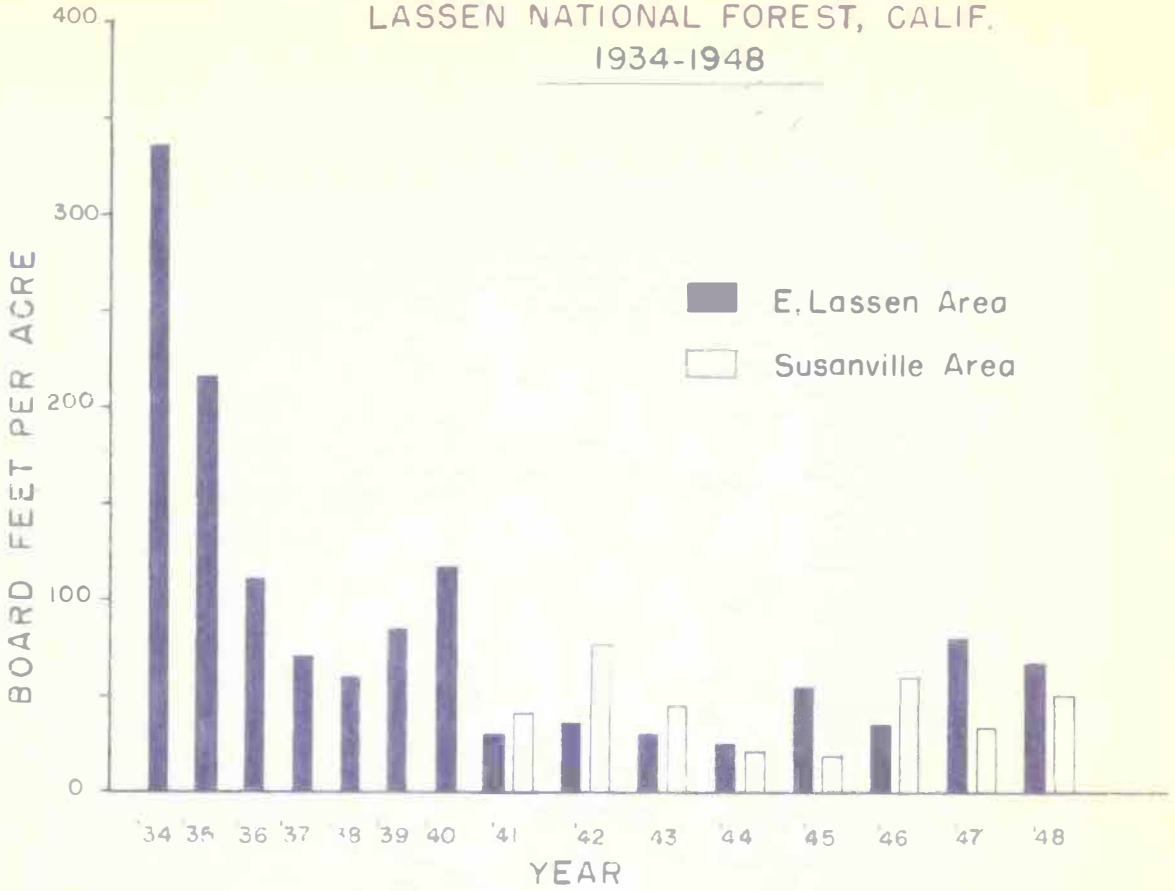
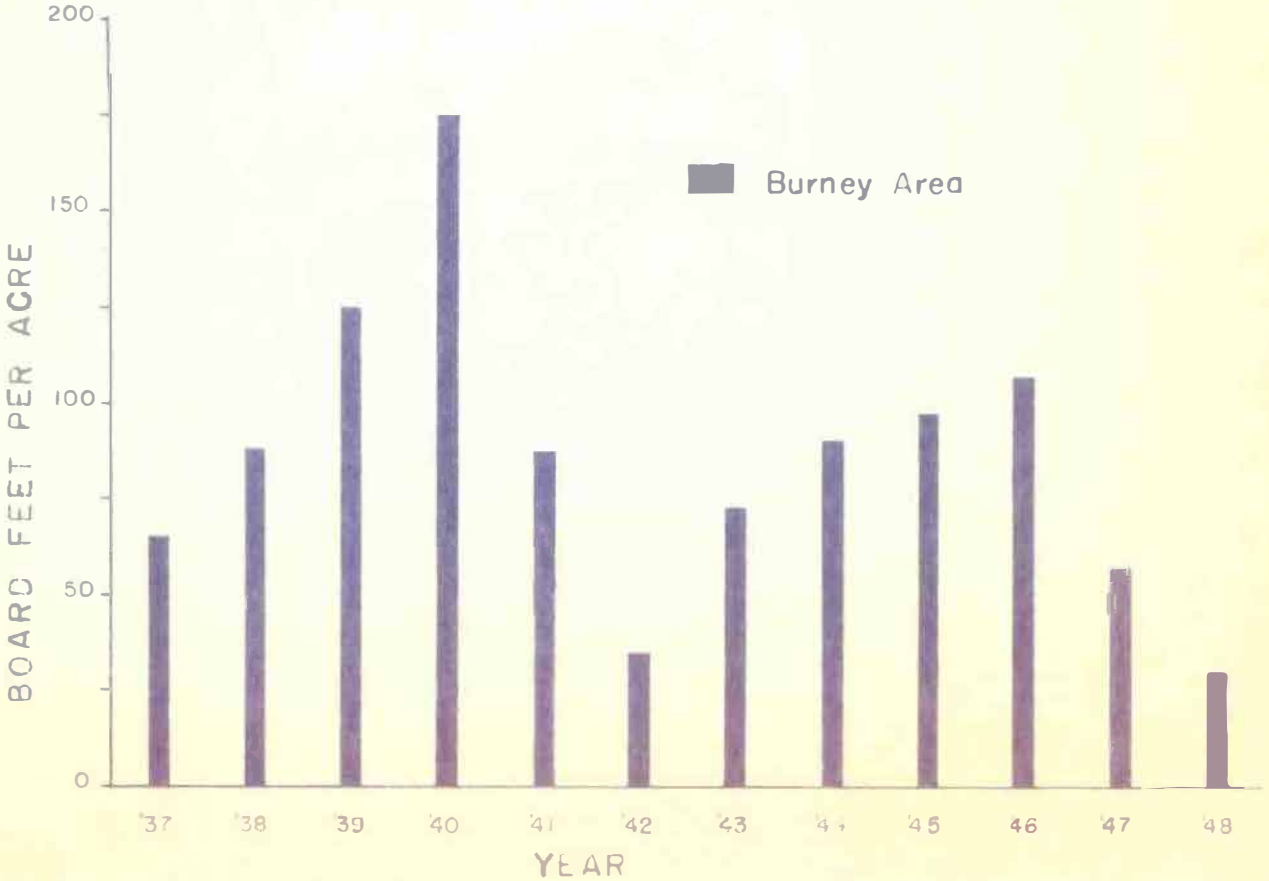
PINE LOSSES
LASSEN NATIONAL FOREST, CALIF.
1934-1948





previous years. Sugar pine loss was concentrated mainly at the higher elevations of the Hat Creek unit, where nearly two percent of the green stand has been attacked and killed.

There was no evidence of aggressive infestation in reserve stands by pine engraver beetles, nor were there any centers of epidemic loss encountered during 1949 in any of the area covered by the survey.

TREND OF BARK BEETLE INFESTATIONS

In general, timber loss due to bark beetles in the Burney Area decreased perceptibly in 1948. Sugar pine loss was the exception, however, and a rising rate of sugar pine mortality was encountered wherever this species was present in the stand. The total loss in all species is well below epidemic levels. Figure 2 graphically represents the trend of pine losses in the Burney Area for the past eleven years.

INSECT-CAUSED LOSS ON SAMPLE PLOTS DURING 1948

In order to determine the amount, intensity and kind of insect activity present in the commercial timber stands of the reporting area, annual measurements of tree mortality are made of the sample plots located throughout the forest. A summary of the plot measurements giving the number of trees killed, the board foot volume of loss, and the percent of stand depletion is shown in table 3. Severity of loss, as indicated by the table, was quite variable on the respective plots, but the major portions of loss occurred in ponderosa pine. The highest rate of loss was sustained along the eastern edge of the reporting area.

ESTIMATED INSECT-CAUSED LOSS IN VIRGIN TIMBER STANDS DURING 1948

By expanding the sample plot measurements of loss to the remaining virgin acreage in the Burney Area it is estimated that bark beetles

destroyed a total of 3,909,000 board feet of pine and fir timber during 1948. This loss is approximately 0.12 percent of the total merchantable virgin stand volume and does not represent dangerous epidemic conditions. The distribution of the 1948 loss estimates for the several entomological units of the reporting area is given in table 4.

BARK-BEETLE LOSS DURING 1949

The measurement of 1949 losses is only partially complete and information relative to the entire season will not be available until the completion of the 1950 inventory. No attempt, therefore, is made to estimate the total timber drain for 1949, but current records are sufficient to appraise the general trend and intensity of insect activity. An accelerated rate of insect-caused loss is indicated from partial loss records completed during July. Results of an aerial reconnaissance made late in October also indicated there will be a significant increase in timber loss throughout the Burney Area when 1949 records are complete.

CONDITIONS IN CUTOVER RESERVE STANDS

For the most part, loss conditions in the cutover reserve stands are determined by a ground or aerial reconnaissance and no attempt is made to determine the kind and amount of insect activity by plot measurements. However, plot loss measurements are used to determine the effectiveness of light sanitation-salvage cuttings as measures of control, and inventories of beetle-killed trees are being maintained on nearly 3,500 acres of lands where only high risk trees have been removed.

Current loss in the cutover reserve is not critical. Infested trees are few in number and the total loss makes up only a small fraction of gross annual increment. The serious Ips infestations in second growth stands during the period from 1944-1947 have largely subsided and no areas

were encountered which would warrant direct control action. The effectiveness of sanitation-salvage cutting in reducing bark beetle losses is particularly apparent throughout the Burney Flat unit where high risk trees were removed from the stand for control purposes during 1946-1948. A comparison of the seasonal loss on these lightly-cut areas and on surrounding virgin stands is given in the following tabulation:

COMPARISON OF INSECT-CAUSED LOSS ON SANITATION-SALVAGE CUT AREAS AND VIRGIN LANDS

	Board foot per acre loss		
	1946	1947	1948
Virgin timberlands	49.1	62.3	45.6
Sanitation-salvage cut areas	28.7	13.8	16.1

CONTROL RECOMMENDATIONS

In view of the endemic character of insect activity throughout the Burney Area, no direct control measures are recommended. However, the high rate of loss being sustained locally in the high hazard areas of the Burney Flat and Hat Creek entomological units, together with the prospect of a rising loss rate during 1949, warrants close watch in these areas to detect early signs of possible epidemic conditions and heavy loss. It is recommended that sanitation-salvage cuttings be extended into these areas as soon as possible in order to reduce the current loss and prevent the possible development of dangerous centers of infestation. A close watch on the rate of sugar pine loss will be maintained in order that direct control action can be taken if necessary and thereby prevent present conditions from burgeoning into epidemic loss.

Table 3. Coniferous Timber Killed by Bark Beetles on Virgin Sample Plots. Burney Area, Shasta County, California, Season of 1948.

Ento. Unit	Sample Plot No.	Timb'd Acres	Hazard Rating	Timber Stand Tree Spp.	Timber Stand Volume M.B.M.	Timber Killed in 1948 No. of trees	Timber Killed in 1948 Volume B.M.	Timber Killed in 1948 Volume p/a	Timber Killed in 1948 Percent of stand
Burney Flat	RD-91	220	III-IV	PP	1969	21	13,680	62.2	0.69
	RD-92	128	III-IV	PP	1145	2	780	6.1	0.15
	RP-6	20	IV	PP	177	2	2,920	146.0	1.65
	RP-9	20	IV	PP	180	None	--	--	--
	SP-4	240	III-IV	PP	2148	19	19,890	82.8	0.92
	SP-6	160	III	PP	1446	3	4,360	27.2	0.30
	SP-9	290	III	PP	2620	7	5,930	20.4	0.23
	SP-11	280	III	PP	2292	18	13,950	49.8	0.61
	SP-12	320	III-IV	PP	2864	19	20,710	64.7	0.72
	SP-13	320	IV	PP	2836	8	8,250	25.8	0.29
	SP-14	320	IV	PP	2836	18	15,340	47.9	0.54
Goose Valley	RD-88	104	II	PP	903	None	--	--	--
				WF	1233	1	1,050	10.0	0.85
	RD-89	80	II	PP	694	None	--	--	--
	RD-90	72	II	PP	625	1	1,740	24.1	0.28
				WF	567	1	660	9.2	0.12
	RP-3,5	40	II	PP	349	None	--	--	--
	RP-8	20	III	PP	287	None	--	--	--
Dry Lake	RD-10	60	II	PP	1002	None	--	--	--
				SP	600	1	340	5.7	0.06
				WF	838	1	4,310	71.8	0.51
	RD-80	120	III	PP	1241	1	6,210	52.8	0.50
	RD-81	152	II-III	PP	2056	None	--	--	--
				WF	1644	1	330	2.2	0.02
Doyle Butte	RP-13,16	40	III	PP	429	None	--	--	--
	RP-15,17	30	IV	PP	206	2	1,580	52.7	0.77
Thousand Lakes	RD-82	304	III	PP	2915	2	2,760	9.1	0.95
				WF	1181	1	1,170	3.8	0.99
	RD-83	160	III	PP	1715	1	540	3.4	0.03
	RD-85	216	III	PP	2315	4	3,310	15.3	0.14
				WF	1253	2	2,970	13.8	0.24
	RD-86	120	III	PP	1286	None	--	--	--
				SP	495	2	3,400	28.3	0.69
	RP-19,20,22	60	III	PP	642	None	--	--	--
	RP-21,25	40	II	PP	628	None	--	--	--
Hat Creek	RD-17	416	III	PP	4459	2	4,460	10.7	0.10
				SP	1110	5	19,050	45.8	1.72
	RP-18,23,24	60	IV	PP	582	None	--	--	--
	RP-26	20	III	PP	214	None	--	--	--
Big Springs	RD-18	320	III	PP	4170	3	4,650	14.5	0.11
				WF	676	1	3,270	10.2	0.48
	RD-19	320	III	PP	4170	2	670	2.1	0.02
	RD-19A	344	III	PP	4483	8	10,520	30.6	0.23
	RD-20	224	III	PP	2919	1	4,140	18.5	0.14
	RP-27,28,29	60	III	PP	781	None	--	--	--
	RP-30,31,32	60	III	PP	781	1	2,100	60.0	0.27
	RP-34,37	40	III	PP	521	None	--	--	--
	RP-33,35,38	60	II	PP	681	None	--	--	--
Total Burney Area		5860		PP	61567	145	148,490	25.3	0.24
				SP	2205	8	22,790	3.9	1.03
				WF	7392	8	13,760	2.3	0.19
			TOTAL		71164	161	185,040	31.5	0.26

Table 4. Estimated Virgin Coniferous Timber Killed by Bark Beetles in 1948. Burney Area, Shasta County, Season of 1948.

Entomological Units	Virgin Timber Stands (As of Jan. 1, 1949) Acreage	Tree Spp	Vol. MBM	Pine Timber Killed in 1948 No. Trees	Volume M.B.M.	bm/acre	% stand
Burney Flat	19,223	PP	170,172	961	878	45.7	0.52
		SP	94	None	None	None	None
Goose Valley	21,250	PP	249,194	170	324	15.2	0.13
		SP	99,588	51	110	5.2	0.11
		WF	163,123	128	115	5.4	0.07
Dry Lake	16,954	PP	241,893	136	178	10.5	0.07
		SP	55,312	51	30	1.8	0.05
		WF	100,967	102	124	7.3	0.12
Doyle Butte	12,170	PP	118,039	134	136	11.2	0.12
		SP	27,199	11	16	1.3	0.06
		WF	25,608	24	33	2.7	0.13
Thousand Lakes	34,526	PP	526,447	276	252	7.3	0.05
		SP	89,542	69	131	3.8	0.14
		WF	254,003	104	159	4.6	0.06
Hat Creek	11,729	PP	117,216	35	84	7.2	0.07
		SP	21,297	129	427	36.4	2.00
		WF	21,934	None	None	None	None
Big Springs	43,905	PP	527,946	176	680	15.5	0.13
		SP	50,524	59	131	2.6	0.25
		WF	282,387	44	101	2.3	0.04
Total of Burney Area	159,757	PP	1,950,907	1888	2532	15.9	0.13
		SP	343,556	370	845	5.3	0.24
		WF	848,022	402	532	3.3	0.06
		TOTAL	3,142,485	2660	3909	24.5	0.12

WESTSIDE LASSEN AREA

In past years the annual forest insect survey for the Westside Lassen Area has been primarily an extensive reconnaissance and only a few sample plots were maintained to determine the amount of loss and kind of insect activity present. During 1949, several additional plots and strips were established throughout the mixed conifer stands of this area to sample and measure insect-caused loss on 135,000 acres of virgin timber. Sample plots used for measuring insect-caused loss now total 2,151 acres and additional plots or strips are planned to insure adequate appraisal of loss for all important areas.

The acreage and resource data as given in the tables of this report were obtained from "Forest Survey Release Number 4", a publication prepared by the California Forest and Range Experiment Station[1/] and from the files of the Forest Supervisor's Office at Susanville, California. Unfortunately, some of the data needed for a complete accounting of resources were not available from any known source and, as a result, some of the estimates of total loss for the reporting area may be subject to error.

CONDITIONS ENCOUNTERED DURING THE COURSE OF THE SURVEY

Sugar pine loss was at a moderate level, but appeared to be on the upswing as a result of increased mountain pine beetle activity over the entire westside area. One area of concentrated activity by both the mountain pine beetle and the western pine beetle was in and around Sugar Pine Flat, Townships 29 and 30 North and Ranges 2 and 3 East, Mount Diablo Meridian. In this local area it is estimated that current loss approximates 150 board feet per acre.

1/ Forest Areas, Timber Volumes and Vegetation Types in Calif., A. E. Wieslander, H. A. Jensen. Calif. Forest & Range Expt. Sta., March 1, 1946.

AGENTS RESPONSIBLE FOR TREE MORTALITY DURING 1948 AND 1949

Primary tree-killing insects found in the mixed conifer forests of the Westside Lassen Area are the same species responsible for tree-killing in the predominantly yellow pine stands of the Eastern Lassen, Susanville and Burney Areas. The relative economic importance of these forest pests is somewhat altered as a result of the difference in stand composition found on the areas. In both forest types the western pine beetle remains the most destructive of the forest insects, but the mountain pine beetle assumes a more important role as a forest destroyer in the mixed conifer type with its higher percentage of sugar pine.

CHARACTER OF INFESTATIONS DURING 1948 AND 1949

Bark beetle-caused loss is of an endemic character over most of the reporting area. It was scattered throughout the forest generally and consisted preponderantly of mature to over-mature ponderosa and sugar pine. Group killing was observed only in the Sugar Pine Flat area north of Mineral and is restricted to the small plateau west and north of Gray's Peak. Some white fir mortality was present in the reporting area, but loss of this species was at a low level. Much of the loss in white fir occurred in small trees or as top-killed larger individuals.

TREND OF BARK-BEETLE INFESTATIONS

Lack of previous quantitative surveys in the Westside Lassen Area precludes a direct comparison of the 1948 record with past losses and the subsequent establishment of an observable trend; however, endemic loss conditions now prevail over most of the reporting areas, as has usually been the case in past years.

A rising rate of loss in ponderosa pine and sugar pine is indicated and a close watch should be maintained in order to detect signs of aggressive infestations and possible heavy loss.

INSECT-CAUSED LOSS ON SAMPLE PLOTS DURING 1948

Newly established sample plots scattered throughout the Westside Lassen Area will be cruised annually to determine the yearly drain of timber resources resulting from insect attacks. A summary of the 1948 plot measurements giving the number of trees killed, the board foot volume of loss and the average loss per acre is found in table 5. As indicated by this table losses were variable on the respective samples and over 90 percent of the total mortality was in ponderosa and sugar pine.

ESTIMATED INSECT-CAUSED LOSS IN VIRGIN TIMBER STANDS DURING 1948

An estimate of the total drain of timber resources of the Westside Lassen Area is obtained by expanding the sample plot measurements of loss to the remaining virgin timber. On this basis it is estimated that bark beetles destroyed a total of 6,126,000 board feet of merchantable timber during 1948, approximately 0.3 percent of the total merchantable stand volume. Table 6 contains a breakdown of the estimated timber loss for the three working circles comprising the Westside Lassen reporting area.

BARK-BEETLE LOSS DURING 1949

Current records on partial 1949 losses coupled with impressions gained during the aerial reconnaissance of the Westside Lassen Area in late October are sufficient to appraise the general trend and intensity of insect activity for the 1949 season.

Sugar pine loss can be expected to increase over that of the previous year and ponderosa pine loss will also swing upward. The general effect will materially increase the total 1949 insect-caused loss.

LOSS CONDITIONS IN CUTOVER RESERVE STANDS

Records and measurements of loss on areas cut by sanitation-salvage methods were initiated in 1949 on two roadside strips totaling 320 acres in the transition zone between east and westside timber types. Insect damage to ponderosa pine on these strips was considerably lower than loss measured on the strips sampling virgin conditions. Sugar pine loss was, as to be expected, apparently unaffected by the light cutting. With the exception of the two strips sampling sanitation-salvage benefits no attempt is being made to determine by successive measurement insect-caused mortality in cutover reserve stands. No serious damage resulting from insect pests was noted, however, in cutover stands during the course of the survey.

CONTROL RECOMMENDATIONS

The relatively high rate of sugar and ponderosa pine loss being sustained on the Sugar Pine Flat Unit of the Diamond Match Company's Viola Tract was first detected in September, 1949, by a forest insect survey crew measuring loss on two established road strip sample plots in the immediate vicinity of the infestation. A subsequent check of the area was made in October which indicated that loss on the sample strips was higher than first expected. Previous records of loss in this area plus current loss information indicated that bark-beetle killing had increased to such an extent that control action was warranted to prevent the possibility of epidemic loss; therefore, in November, recommendations were made to the Diamond Match Company for salvage of beetle-killed timber on an area of approximately 10,200 acres of company-owned land in the Viola Tract. In February, 1950, an aerial examination of the

Viola Tract was made for the purpose of (1) delineating the boundaries of the infestation area for use in requesting the establishment of a zone of infestation by the California State Board of Forestry, (2) obtaining an estimate of the total number of infested trees present in the infestation area, and (3) locating the centers of heavy infestation within the area. As a result of the aerial examination the area comprising the zone of infestation was increased to 17,500 acres, of which 15,520 acres are privately owned, and an estimate of the number of beetle-killed trees involved in possible control action was made. The total number of trees attacked by bark beetles was determined by using the information obtained from the road strip sample plots modified by the aerial count. This estimate is as follows:

Tree Species	Number of trees	Volume bd. ft.	Av. vol. p/a
Sugar pine	560	2,055,000	117
Ponderosa pine	205	574,000	33
Total	765	2,629,000	150

On the basis of the estimated current loss present on the Viola Tract, the economic values of the merchantable timber involved, and the indications of increased insect-caused loss in 1950, recommendations were made for a salvage control program where all infested and recently abandoned trees would be harvested and utilized. Unfortunately, it now appears that no salvage control action will be undertaken by the operators primarily concerned this year.

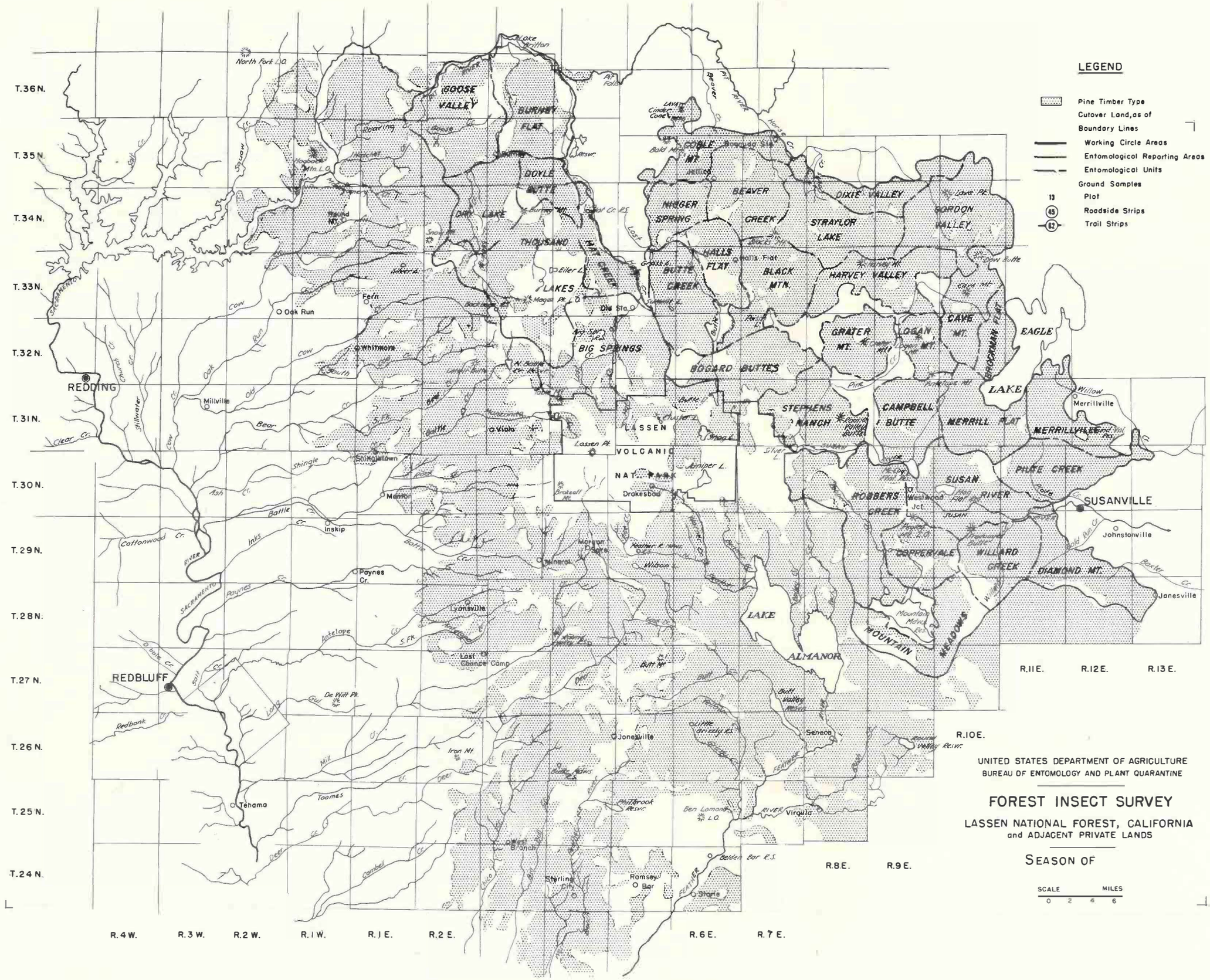
The endemic loss conditions existing over the rest of the westside Lassen area do not warrant direct control action this season. It will be necessary, however, to maintain constant surveillance over insect activity in this area lest the increasing rate of loss develop into serious outbreaks before control action can be taken.

Table 5. Coniferous Timber Killed by Bark Beetles on Virgin Sample Plots, West Lassen Area, in Portions of Shasta, Tehama, Butte and Plumas Counties, California, Season of 1949

Working Circle	Sample Plot No.	Timb'd Acres	Tree Species	No. of trees	Trees Killed in 1948	
					Volume B.M.	Volume per acre
Western Lassen	RD-67	40	PP	None	--	--
			SP	1	160	4.0
	RD-68	160	PP	2	3530	22.0
	RD-69	160	PP	2	2470	15.4
	RD-70	80	PP	None	--	--
	RD-71	80	PP	2	2510	31.4
	RD-63	160	PP	None	--	--
	RD-73	216	PP	3	6770	31.3
			SP	8	19580	90.6
			WF	7	7440	34.4
Almanor	RD-64	80	PP	1	1440	18.0 + 2 strips in Sani-Sal areas RD-65 & 66
Outside W. C. Areas	RD-55	160	PP	2	9010	56.3
	RD-56	160	PP	None	--	--
	RD-57	80	PP	1	440	5.5
	RD-58	160	PP	None	--	--
	RD-59	135	PP	None	--	--
	RD-60	80	PP	2	19630	245.3
	RD-61	80	PP	None	--	--
	RD-72	160	PP	2	6060	37.9
	RD-74	160	PP	8	9120	57.0
			SP	1	340	2.1
			WF	1	160	1.0
Total of West Lassen Area		2151	PP	25	60980	28.3
			SP	10	20080	9.3
			WF	8	7600	3.5
			TOTAL	43	88660	41.1

Table 6. Estimated Virgin Coniferous Timber Killed by Bark Beetles in 1948, Western Lassen Area

Working Circle	Virgin Timber Stand (As of Jan. 1, 1949) Acreage	Tree Spp.	Volume M.B.M.	Timber Killed in 1948 No. Trees	Volume M.B.M	bm/acre	% stand
Western Lassen	34,800	PP	172,370	348	592	17.0	0.34
		SP	205,940	348	766	22.0	0.37
		WF	284,730	278	289	8.3	0.10
Almanor	63,870	PP	277,540	639	1,239	19.4	0.45
		SP	345,270	511	1,258	19.7	0.36
		WF	472,510	447	498	7.8	0.10
Magalia	36,100	PP	152,440	397	1,022	28.3	0.67
		SP	146,940	180	336	9.3	0.23
		WF	229,940	144	126	3.5	0.05
Total for Western Lassen	134,770	PP	602,350	1,384	2,853	21.2	0.47
		SP	698,150	1,039	2,360	17.5	0.34
		WF	987,180	869	913	6.8	0.09
		TOTAL	2,287,680	3,292	6,126	45.5	0.28


LEGEND
Pine Timber Type
Cutover Land, as of
Boundary Lines
Working Circle Areas
Entomological Reporting Areas
Entomological Units
Ground Samples
13 Plot
45 Roadside Strips
82 Trail Strips
T.36N.
T.35N.
T.34N.
T.33N.
T.32N.
T.31N.
T.30N.
T.29N.
T.28N.
T.27N.
T.26N.
T.25N.
T.24N.
R.4W.
R.3W.
R.2W.
R.1W.
R.1E.
R.2E.
R.6E.
R.7E.
R.8E.
R.9E.
R.10E.
R.11E.
R.12E.
R.13E.
GOOSE VALLEY
BURNEY FLAT
DOYLE BUTTE
DOG LAKE
THOUSAND LAKES
BIG SPRINGS
BOGARD BUTTES
NIGGER SPRING
BEAVER CREEK
HALLS FLAT
BUTTE CREEK
BLACK MTN.
DIXIE VALLEY
STRAYLOR LAKE
HARVEY VALLEY
GORDON VALLEY
GRATER MT.
LOGAN MT.
CAVE MT.
EAGLE LAKE
STEPHENS RANCH
CAMPBELL BUTTE
MERRILL FLAT
MERRILLVILLE
PILOT CREEK
SUSAN RIVER
ROBBERS CREEK
COPPERVALE
WILLARD CREEK
DIAMOND MT.
LAKE ALMANOR
MOUNTAIN MEADOWS
LASSEN VOLCANIC NAT. PARK
REDDING
REDBLUFF
Millville
Oak Run
Whitmore
Fern
Shingletown
Manton
Inskip
Paynes Cr.
Mineral
Lyonsville
Last Chance Camp
De Witt Pk.
Tehama
Jonesville
Seneca
Virgilia
Ben Lomond L.O.
Sterling City
Ramsey Bar
Belden Bar R.S.
Storie
Drakesbad
Lassen Pk.
Brokeoff Mt.
Juniper L.
Hat Creek
Battle Cr.
Cottonwood Cr.
Inks Cr.
Antelope Cr.
Deer Cr.
Mill Cr.
Toomes Cr.
Redbank Cr.
Salt Cr.
Oak Run
Cow Cr.
Shingle Cr.
Ash Cr.
Clear Cr.
Church Cr.
Shillwater Cr.
Old Cr.
Bear Cr.
Squaw Cr.
Hog Cr.
Soldier Cr.
Burney Cr.
Horse Cr.
Beaver Cr.
Pit River
Lake Britton
North Fork L.O.
Hogback Mtn. L.O.
Round Mt.
Snow Mt.
Burney Mt.
Eiler L.
Magee Pk.
Big Spr. R.S.
Whitmore Cr.
Horsetown
Oak Run
Old Station
Lassen Pk.
Juniper L.
Brokeoff Mt.
Drakesbad
Manton
Inskip
Paynes Cr.
Mineral
Lyonsville
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Sterling City
Ramsey Bar
Belden Bar R.S.
Storie
Westwood Jct.
Susanville
Johnstonville
Janesville
Merrillville
Willow
Lake Pk.
Brown Butte
Harvey Mt.
Grizzly Pk.
Iron Mt.
Mt. Hough
Mountain Meadows Reservoir
Antelope Reservoir
Butt Valley Reservoir
Almanor Reservoir
Mt. Harkness
Fredonyer Butte
Observation Pt.
Mt. Hough L.O.
Peak 6609
Peak 6670
Peak 6670
Peak 6670